

Sustained decrease in pediatric asthma emergency visits during the first year of the COVID-19 pandemic

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ABSTRACT

Background: On January 20, 2020, the first documented case of novel severe acute respiratory syndrome coronavirus 2 (coronavirus disease 2019 [COVID-19]) was reported in the United States. The U.S. Centers for Disease Control and Prevention continues to report more morbidity and mortality in adults than in children. Early in Pandemic, there was a concern that patients with asthma would be affected disproportionately from COVID-19, but this was not manifested. It is now recognized that angiotensin-converting enzyme 2 receptors that are used by the coronavirus for infection have low expression in children with atopy that may contribute to decreased infectivity in children who are atopic. There are several early reports of decreased emergency department (ED) visits for children with asthma. The authors previously reported a decrease in pediatric ED visits in the spring of 2020, which correlated with school closure.

Objective: To determine if this trend of decreased ED visits for pediatric asthma was sustained throughout the first COVID-19 pandemic year.

Methods: ED data from one inner city children's hospital were collected by using standard medical claims codes.

Conclusion: We reported a sustained year of decreased ED visits for children with asthma in one pediatric ED in an inner-city hospital; this seemed to be secondary to school closure and decreased exposure to upper respiratory infections.

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On January 20, 2020, the first documented case of novel severe acute respiratory syndrome coronavirus 2 (coronavirus disease 2019 [COVID-19]) was reported in the United States.¹ As of March 24, 2021, the U.S. Centers for Disease Control and Prevention had reported 30.1 million cases and 547,600 deaths from COVID-19 in the United States²; among those, 460,815 cases were in children 0–4 years of age and 2,241,577 were in children 5–17 years of age. As of March 24, 2021, there have been 101 COVID-19 related deaths of children ages 0–4 years and 226 deaths of children ages 5–17 years.³ It is still not entirely clear why the virus affects children differently than adults. Early in the pandemic, it was feared that children with asthma would be at very high risk for COVID-19 morbidity and mortality, but those initial predictions did not materialize, and, paradoxically, atopy in children was suggested to be protective because angiotensin-converting enzyme 2 (ACE2) receptors that are used

by coronavirus for infection have low expression in children with atopy.^{4,5}

Severe acute respiratory syndrome coronavirus 2 uses a combination of ACE2 and transmembrane protease serine 2 (TMPRSS2) to infect the host organism.⁶ Sputum samples from adult patients with asthma who were on inhaled corticosteroids have been shown to have decreased ACE2 and transmembrane protease serine 2 receptors.⁶ Children from the Urban Environment and Asthma Cohort Study had sampling of nasal epithelium at their enrollment at age 11 years, and ACE2 RNA expression was found to be inversely related to allergic sensitization, and allergic asthma was associated with further reduction in ACE2 expression.⁵ Inhaled corticosteroid use in children did not, however, seem to affect ACE2 receptor expression as it did in adults.⁵ A review of 182 pediatric patients with COVID-19, median age 6 years (range, 3 days to 15 years), found that there was no difference in severity or disease progression between patients who were allergic and/or asthmatic and patients who were not allergic, although children who were atopic showed less increase in inflammatory markers than children who were nonatopic during acute COVID-19.⁷ By the summer of 2020, there were data, analysis of which suggested that asthma in adults was not a risk factor for hospitalization with COVID-19 infection.⁸

One emergency department (ED) in the Bronx, New York, saw a significant decline in the number of pediatric admissions for acute asthma in the early months of the pandemic, with the proportion of total visits for asthma

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Table 1 2019 vs 2020 Pediatric emergency department visits: The entire year vs seasonal totals

Year	Entire year (365 days)	Before Closure: Jan 1 to Mar 15 (90 days)	After Closure: March 16 to Dec 31 (275 days)	Spring: March 15 to May 31 (79 days): Total ED Visits (DAILY AVG+SD)	Fall: Aug 1 to Oct 31 (92 days): Total ED Visits (DAILY AVG+SD)
2019	4807 (14 ± 7)	942 (13 ± 5)	3923 (15 ± 8)	1304 (18 ± 5)	1613 (18 ± 10)
2020	2129 (6 ± 5)*	987 (13 ± 5)	1142 (4 ± 3)*	260 (AVG 4 ± 4)*	482 (5 ± 3)*

* $p < 0.0001$.

Table 2 2019 vs 2020 Monthly totals for pediatric emergency department visits

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2019	354	366	452	377	441	291	180	358	732	523	594	154
2020	395	407	335	75	57	86	104	117	130	235	165	23

shifting from 7% to 2%.⁹ The Ljubljana Children's Hospital in Slovenia saw a significant drop in the number of pediatric asthma admissions during the first 5 weeks of the state's lockdown, and a Children's Hospital in Boston, Massachusetts, also reported decreased asthma admissions during the early months.^{10,11} Admissions for asthma, bronchitis, bronchiolitis, and pneumonia were reported to be decreased compared with the previous 5 years of data collection in a collaborative study.¹² We noted a decrease in pediatric asthma admissions with school closure (decrease in April and May of 2020, to an average of less than one admission daily compared with our usual of three to four daily in those months) and decided to examine the ED data to be sure that the overall decrease in ED visits for children was not simply allowing longer stays in the ED and avoidance of admissions. The authors previously reported a decrease in pediatric asthma ED admissions during the school closure for COVID-19 in the spring of 2020, and now we report a sustained decrease in pediatric ED visits for the first year of COVID-19.¹³

METHODS

The total number of ED visits for pediatric asthma were collected by using standard medical claim codes at one inner city children's hospital in Detroit, Michigan. Data were collected for a full 1-year (365 days) period in 2019 and 2020. The study was exempted by the institutional review board of Wayne State University.

RESULTS

Pediatric ED visits for asthma dropped from 4865 total yearly visits in 2019 to 2129 in 2020, and the average number of ED visits (all data given as average ± standard deviation) dropped from 14 ± 7 in 2019 to an

average of 6 ± 5 in 2020 ($p < 0.0001$). However, 987 ED visits in 2020 were before the schools shut down on March 15 (January 1 to March 15), which revealed no statistical difference to the 942 children seen for asthma in the ED before March 15 in 2019. There were 1142 ED visits for the remainder of the year (March 16 to December 31) in 2020, which was significantly decreased from the 3923 for the same time period in 2019 (15 ± 8 visits per day in 2019 versus 4 ± 3 in 2020) ($p \leq 0.0001$) (Table 1).

Spring of 2020 after school closures and late summer through fall of 2020 witnessed the most significant decreases in ED admissions for asthma. In the spring of 2020, after school closures (March 15 to May 31), the total number of pediatric ED visits for asthma was 260 compared with 1304 visits the previous year (2019) ($p < 0.0001$) in the same time period. The average number of ED visits dropped from 18 ± 5 (2019) to 4 ± 4 (2020) between March 15th and May 31st. March 15th was the official school closure day for schools in Michigan in 2020 due to the pandemic. The ED admissions in the late summer through the fall of 2020, a time when there is usually a rise in pediatric ED visits for asthma, dropped significantly when compared with ED admissions in the same time period in 2019. There were 1613 ED visits between August 1, 2019, and October 31, which decreased to 482 in the same time period in 2020 ($p < 0.0001$). The average daily ED visits for asthma in the late summer through fall dropped from 18 ± 10 in 2019 to 5 ± 3 in 2020. Starting in March, there was a decrease in ED visits for asthma each month throughout 2020 (Table 2).

DISCUSSION

The reasons for this decrease in ED visits for pediatric asthma during the school closures for COVID-19 may

be, in part, related to decreased pollution with the shutdown of industry and the decrease of automobile traffic.¹⁴ It seemed most likely, however, given the data on decreased bronchiolitis, bronchitis, and pneumonia as well as decreased reports of influenza and other infections during COVID-19 shelter-at-home period and school closures that the decrease in asthma was directly related to the decrease in exposure to infectious agents.¹² Although the school closures decreased the spread of COVID-19, this also decreased exposure to other usual viral infections that exacerbate asthma.

CONCLUSION

With these data, it is hard to ignore the need for in-school accommodations for patients with asthma in the post-pandemic world. Should they continue to wear masks at school, especially during viral outbreaks? Should classroom sizes be modified for patients with asthma? Should the patients with the most severe asthma be offered a hybrid model of small class size part of the time and in-home virtual classroom the rest of the time? Although these accommodations may seem the ideal answer to decrease infections, they may not be socially, financially, and practically acceptable to families and school administrators. The data over the next year with schools reopening will be critical in helping to answer these questions.

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